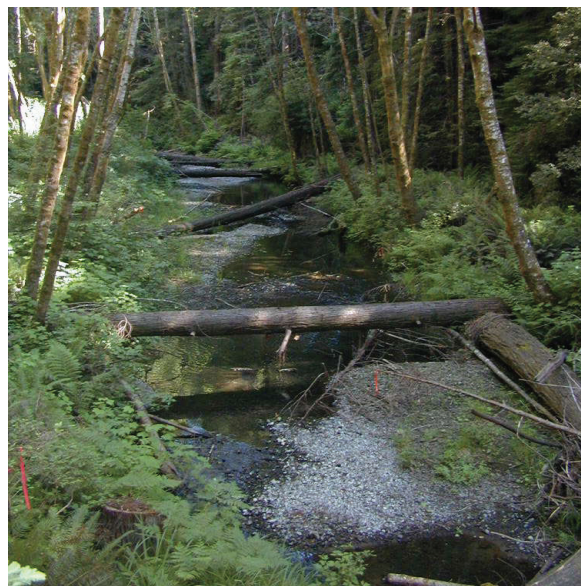




## The Caspar Creek Watershed Study Completes 40 Years of Research

State and Federal Cooperative Research at  
Caspar Creek Experimental Watersheds  
by Dr. Thomas Lisle, USFS

For more than forty years, the California Department of Forestry and Fire Protection (CDF) and the USDA Forest Service, Pacific Southwest Research Station (PSW) have cooperated in a comprehensive watershed study at the Caspar Creek Experimental Watersheds on Jackson Demonstration State Forest near Fort Bragg. When formal cooperation began in 1962, the objective was to document hydrologic changes, erosion impacts, and sediment production resulting from road construction and logging second-growth forests. For the past 20 years, the two agencies have jointly evaluated potential cumulative watershed effects resulting from even-age and uneven-age silviculture, including responses in streamflow routing, sediment transport, water quality, fisheries, and other biological (algal and benthic macro invertebrate) communities. The Caspar Creek data represent the only long-term hydrologic information from managed second-growth conifer forests in the western U.S. Because of its long record and unique conditions, information from Caspar Creek will continue to be valuable to both



Caspar Creek

the research and the land management communities as second- and third-growth forests are increasingly re-entered.

This long-term cooperation between CDF and PSW has been a productive division of labors. The two agencies have jointly decided which studies to undertake, with CDF supervising the construction and maintenance of research facilities and managing the experimental

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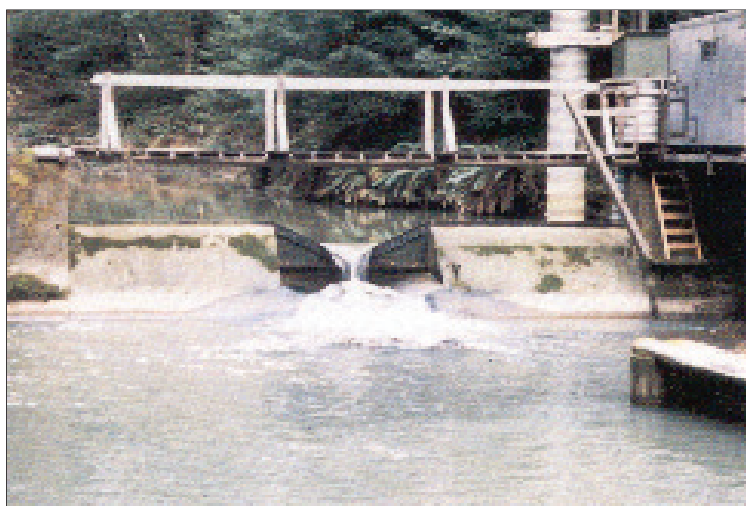
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### Road 600 Stream Crossing Removal

As part of phase three of the Caspar Creek studies, some logging roads located in riparian zones are being decommissioned. The road system will be moved closer to the ridgetops of the watershed in an effort to reduce the number of stream crossings and sediment sources. This will also decrease culvert maintenance and long-term erosion of the stream bank at stream crossing locations. Proper road, landing, and crossing design is the key to minimizing environmental damage and the costs of construction and maintenance. New and reconstructed roads and landings will be outslopped for surface drainage.

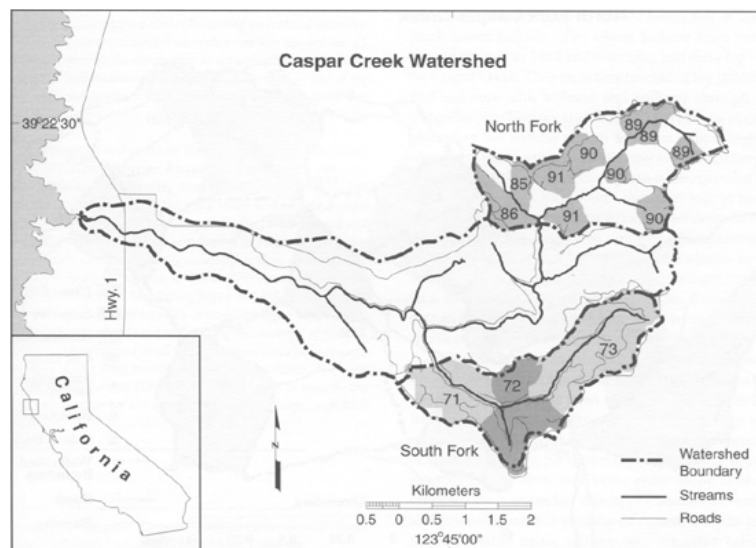


### North Fork Weir

The North and South Fork Weirs were installed in 1962 for phase one of the Caspar Creek Watershed Study. Measurements taken at these weirs have also been used in phase two and phase three. Each weir includes a fish ladder for spawning salmon and calibrated gages for measuring the suspended sediment load, or turbidity, carried by the water before, during and after road construction and timber operations. The weirs also measure streamflow, which changes with the seasons and can increase dramatically during storm events.

### Caspar Creek Watershed

Caspar Creek lies approximately five miles south of Fort Bragg, California and sits right about in the middle of Jackson Demonstration State Forest. It covers 2,400 acres of second-growth conifer forestland containing coast redwood, Douglas-fir, western hemlock and grand fir. The hills are uplifted marine terraces deeply incised by antecedent drainages and the soils of the basins are well-drained clay-loams. The climate is typical of low-elevation watersheds on the central North American Pacific coast where winters are mild and wet while summers are cool and dry. The Caspar Creek Watershed Study is one of the most intensive long-term paired watershed studies in the world, and over 150 technical publications have been authored using the data collected here.



*continued from page 1*

watersheds, and PSW designing the experiments and analyzing the data. Together, CDF and PSW have authored over 150 technical publications as a result of this joint effort. These are listed on the web page of the Redwood Sciences Laboratory and many are available online at [www.rsl.psw.fs.fed.us](http://www.rsl.psw.fs.fed.us).

Small experimental watersheds such as those at Caspar Creek permit detailed studies of physical and biological interactions in a relatively controlled environment. Experimental disturbances can be imposed at a temporal and spatial scale that allows the researcher a chance of correctly identifying cause and effect. Further, although such small-watershed studies are only case studies, they can establish some sideboards on the more outrageous claims that appear now and then. It is not unusual to hear claims that "logging will dry up the streams and springs" or "logging will produce devastating floods" or "logging does not increase stream sediment loads." The Caspar Creek studies have shown that none of these claims are true for the conditions found at Caspar Creek. For example, logging about half the timber volume, either by clearcut or selective cut, did not have a significant effect on important peak streamflows, that is, those flows affecting the morphology of the channel. However, increased stormflow volume after logging was most important in explaining increased suspended sediment load. Further, logging increased soil moisture and summer low flow, subsurface and soil pipe flow, woody debris, and modified other riparian conditions.

Results from Caspar Creek are being used by state and federal agencies charged with regulating how forestry practices affect flooding, water supply, water quality, riparian condition, aquatic habitat including endangered fish. Because of a renewed emphasis on science-based decision-making, the results are invoked frequently by advocates from all sides in debates over forest management in northern California. In addition, sampling methods developed recently at Caspar Creek for measuring sediment loads are being adopted for monitoring by agencies, non-profits, and private

industry as forest impacts come under increasing public scrutiny.

The present condition of the South Fork watershed is typical of much of the tractor-logged lands in the redwood region that are entering their third harvest cycle. It is becoming evermore important for landowners, regulatory agencies, and the public to understand the interactions between proposed future activities and prior disturbances. Therefore, a third phase of studies is being initiated in the South Fork, where 10 new gaging stations were installed in 2000 to examine the effects of selection or group selection harvesting on runoff and sediment production from previously tractor-logged redwood forests.

Such a long-term research and management venture between a state and federal agency is unique. The results to date and a continuation of this cooperation will be priceless to future generations. Consequently, CDF and PSW have agreed in principle to continue cooperative research at the Caspar Creek Experimental Watersheds for the next 100 years. This may seem like a long commitment, but this is the time frame upon which forest land managers must operate. To better foster this long-term cooperative work, a barracks/office facility is now being constructed as the first phase of what will become the Jackson Demonstration State Forest Learning Center.

*Thomas E. Lisle is a Research Hydrologist with the USDA Forest Service, Pacific Southwest Research Station*

"The results to date and a continuation of this cooperation will be priceless to future generations."



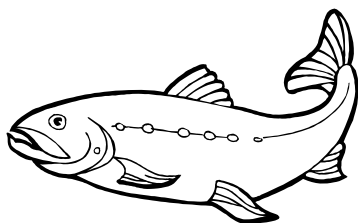


## Current Research Projects at Caspar Creek

### Hydrologic-Response Simulations for Caspar Creek: A Process-Based Characterization of Cumulative Watershed Effects

Researcher: Adrienne Carr, PhD Project  
Stanford University

It is well known, in a qualitative sense, that forest management practices can give rise to cumulative watershed effects (CWEs). The science associated with assessing CWEs has been primarily empirically-based. There is a huge gap in the understanding of the physical processes that control the changes in watershed function resulting from timber harvest and the associated activities. The approach used in my research is physics-based numerical simulation of surface and near-surface hydrologic response for forested systems designed to test the hypothesis that timber harvest can alter watershed function. The study includes comprehensive numerical simulation combined with and driven by rigorous field study to address questions related to hydrologic response at the sub-watershed and watershed scales. At the heart of this work are (i) the well-characterized experimental watershed (Caspar Creek) and (ii) a state-of-the-art, physically-based hydrologic-response model (the Integrated Hydrology Model). Changes in hydrologic response resulting from alternative land management activities will be investigated in a "what if" simulation mode. The numerical experiments in this study will aid in the concept development of both future field and modeling studies of hydrologic response and facilitate the quantitative characterization of data-worth relationships as they are related, for example, to future monitoring strategies designed to understand CWEs at the watershed scale.



### Road Sedimentation Model

Researcher: Chris Keithley  
CDF Fire and Resources Assessment Program

Previous studies within forested watersheds in northern California have shown that the location and condition of the road within a watershed can have a significant effect on the amount of erosion associated with the road system. As a result many forests are developing road management plans to efficiently reduce road related sediment. A road sedimentation model, SEDMODL, was applied to the Caspar Creek watershed on the Jackson Demonstration State Forest. The model was developed by Boise Cascade for forest lands in Idaho and Washington. The structure of the model is flexible enough to easily adapt it to forest lands in northern California.

The model was run on Caspar Creek to evaluate the contribution of roads as part of the basin's sediment budget and to assist in identifying roads that produce relatively high amounts of sediment. Model results suggest that while the ratio of road sediment to background sediment is fairly high (2x), less than half of the roads are expected to contribute significant sediment to streams and an even smaller portion of road segments would be considered chronic sources. The first run used the entire road network to estimate sediment yield. The second model run took into account the removal of over 4.5 miles of roads that have been slated for decommission. Removal of 7% of the total road network reduced predicted road sediment by 9%.

The model has yet to be validated with field observations. A comparison of current sediment yield estimates from SEDMODL with estimates from independent studies indicates that the model results are close to field based estimates. When used as a screening tool the model will provide first level estimates of road sedimentation, assist in identifying roads that are currently chronic sources of sediment, and guide a cost effective plan to reduce road based sediment.



## Turbidity Threshold Sampling

Researcher: USFS, Redwood Sciences Laboratory, Pacific Southwest Research Station

Since 1962, researchers have been studying the nature of hydrologic erosion and sedimentation impacts of logging operations on northern California watersheds. Turbidity threshold sampling was first implemented in water year 1996 at eight gaging stations in the Caspar Creek watershed. One additional gaging station was added in 2000 and ten more gaging stations were added in water year 2001. The data include: streamflow, turbidity, estimated sediment loads, with the additional collection of water and air temperature and rainfall at selected sites. Data are collected and maintained by Redwood Sciences Laboratory, in cooperation with CDF.

Turbidity threshold sampling is an automated procedure for collecting data on suspended sediment in the water. The basic equipment



Collecting stream flow data at Jackson Demonstration State Forest. The data logger takes a sample every 30 minutes.



South Fork Weir

consists of a programmable data logger, a turbidimeter mounted in the stream, a pumping sampler, and a stage-measuring device.

### Recent Research Projects at Caspar Creek

Road Abandonment Study - Bill Baxter, CDF

Large Woody Debris Installation and Monitoring  
Bill Baxter, CDF

Tree-falling Study - Bill Baxter, CDF

Interception Study - E.T. Keppler, USFS, Jack Lewis, USFS, Rand Eads, USFS

Fog Drip Study - E.T. Keppler, USFS, Jack Lewis, USFS, Rand Eads, USFS

Gully Study - Nick Dewy, Graduate Student, Humboldt State University, Tom Lisle, USFS, Leslie Reid, USFS

Road Subsurface Study - E.T. Keppler, USFS

Landslide Inventory & Database - E.T. Keppler, USFS

Evaluating Forst Management Effects on Erosion, Sediment, and Runoff, R.M. Rice & R.R. Ziemer, USFS

Composition of Suspended Load as a Measure of Stream Health - Mary Ann Madej, Ph.D., USGS, Margaret Wilzbach, Ph.D. USGS

Annual Dept. of Fish & Game Salmonid Inventory

## Caspar Creek Hydrologic and Geomorphic Data: A Consultant's Perspective

By Matthew O'Connor, PhD, RG

For more information on the Caspar Creek Watershed studies visit the USFS website at [www.fs.fed.us/psw](http://www.fs.fed.us/psw)

During periods of tight government budgets, it may be tempting to suggest that expensive research projects are an unaffordable luxury lacking in tangible benefits. Research at the Caspar Creek Experimental Watershed is NOT vulnerable to this criticism. As an environmental consultant who deals with issues pertaining to the effects of land uses such as timber harvest and timberland conversion on hydrologic and geomorphic processes, I have routinely referenced research studies and utilized data from Caspar Creek. Jackson Demonstration State Forest and the U.S. Forest Service Redwood Sciences Laboratory ([www.rsl.psw.fs.fed.us](http://www.rsl.psw.fs.fed.us)) have made much of the data and virtually all of the research papers from Caspar Creek available via the Internet.

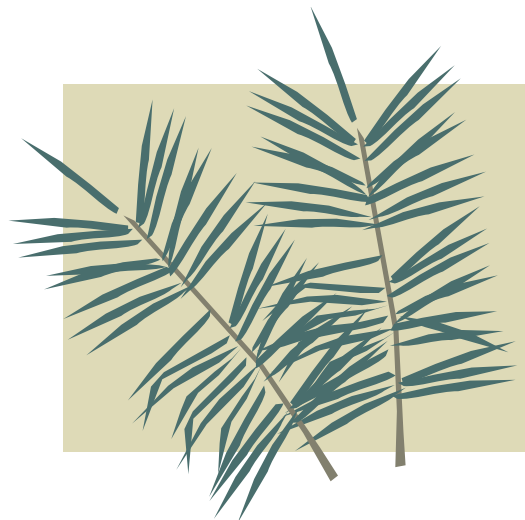
Watershed studies at Caspar Creek have investigated erosion and sedimentation, streamflow, runoff processes, slope stability, large woody debris, water temperature and fish habitat issues, to name a few. These studies and hydrologic data sets provide researchers, consultants and regulatory agencies with the most comprehensive information available on second growth redwood forest ecosystems. The hydrologic data is unique in its level of intensity of monitoring and the ever-lengthening period of record. Techniques developed to measure stream flow and sediment yield at Caspar Creek have been refined over the past twenty years, and have been widely adopted by other researchers and public watershed groups.

It is fair to characterize the existing research results as invaluable, however, the ongoing nature of watershed studies at Caspar Creek creates the prospect of ever more valuable continuous data sets. Maintenance of hydrologic monitoring and development of a new experiment in the South Fork Caspar Creek ensures that the full value of previous data will be realized, and that current questions relating to the effects of management on aquatic systems are addressed through new research.

Adaptation of research questions and related experiments to the evolving field of watershed science parallels the oft-cited adaptive management approach to natural resources management.

The Caspar Creek Experimental Watershed has provided scientific data of great value for evaluation and assessment of environmental impact of timber harvest and other management of coastal forests in the northern California Coast Ranges. Long-term hydrologic data, and the opportunity for new experiments in watershed sciences to evaluate effects of management, will not be easily duplicated anywhere else in the redwood region.

*Matthew O'Connor is a registered geologist and owner of O'Connor Environmental, Inc., Healdsburg, California*



## State Forest Contacts

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### Boggs Mountain Demonstration State Forest

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Cobb, CA 95426  
Forest Manager - Norm Benson  
(707) 928-4378

### LaTour Demonstration State Forest

875 Cypress Ave.  
Redding, CA 96001  
Forest Manager - Scott McDonald  
(530) 225-2505

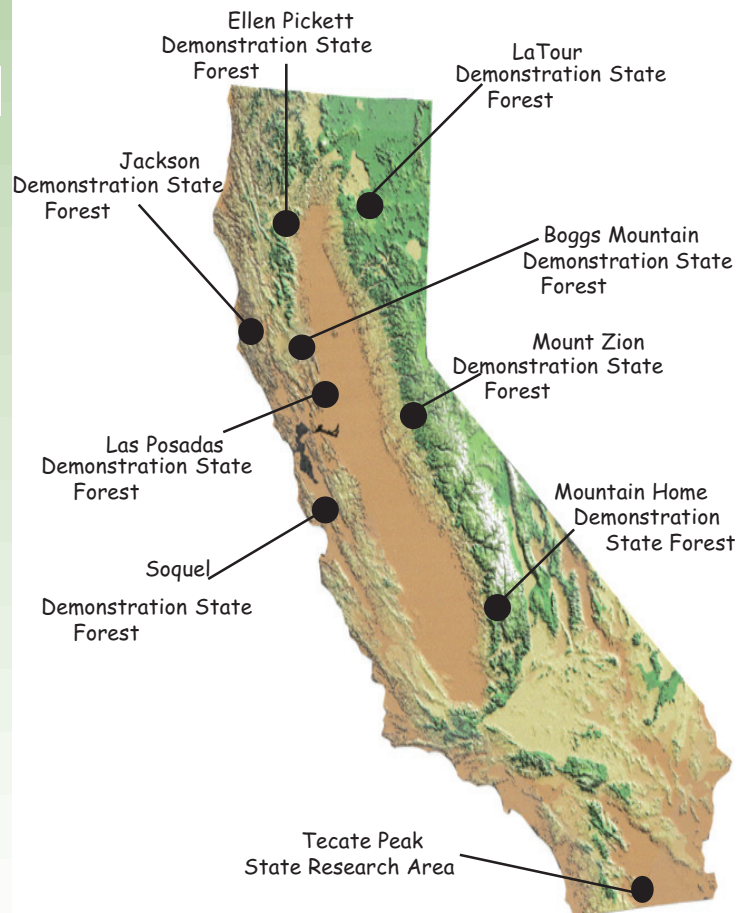
### Soquel Demonstration State Forest

4750 Soquel-San Jose Road  
Soquel, CA 95073  
Forest Manager - Thom Sutfin  
(831) 475-8643

### Mountain Home Demonstration State Forest

P.O. Box 517  
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(559) 539-2855 Winter

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CDF operates eight demonstration State Forests totaling 71,000 acres, and one State Research Area. Five of the forests are actively managed for research and demonstration of economical forest management and timber production. Scientists, research consultants, and graduate students also use the forests as laboratories for a variety of topics including watershed studies, threatened and endangered species conservation and ecological research. The results of their research is published in scientific journals or CDF report publications. The Board of Forestry and Fire Protection policy provides that the primary purpose of the State forest program is to conduct innovative demonstrations, experiments, and education in forest management. Accordingly, the Department will conduct a balanced program of demonstrations and investigations in silviculture, mensuration, logging methods, economics, hydrology, environmental protection, and recreation directed to the needs of the general public, small forest landowners, timber operators and the timber industry.



## State Forests Research and Demonstration Newsletter Kicks Off

This is the first issue of the State Forests Research and Demonstration program's newsletter. With this initial issue we have chosen to highlight the Caspar Creek Watershed Study and the contributions it is making toward a better understanding of the impacts of forest management on the environment.

In future issues, the newsletter will cover research and demonstration projects from California's state forests. Our goal is to keep the public informed of the on-going commitment CDF has to increasing our knowledge base and research data, and to share the findings these projects have produced with foresters, research scientists and the public. We will also keep you informed about other activities that occur on the forests, such as new learning centers, interpretive trails, guided tours, archaeology, and recreation opportunities.

If you would like to be on our mailing list and continue to receive this newsletter, please send an email to: [candace.kraemer@fire.ca.gov](mailto:candace.kraemer@fire.ca.gov) or call us at 916-651-9177. You may also send the coupon provided below. If you choose to call or email us, please list any of the additional publications shown on the coupon that you would like to receive, and indicate whether you prefer to receive a hard copy such as this one or an electronic version in PDF format by CD ROM or email. There is no charge for these publications.

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